

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY: _____
SHEET: 1 of 17

TABLE OF CONTENTS

	DESCRIPTION	PAGE
I.	INTRODUCTION	2
II.	REFERENCE SPECIFICATIONS	2
III.	MACHINE – GENERAL CONDITIONS	2-15
	Machine	2-10
	Controls	10-11
	Machine Inspection and Run Off – Blast Cleaning & Deburring	12
	Machine Inspection and Run Off – Shot Peening	12-14
	Design Approvals	15
IV.	WARRANTY	15
V.	QUOTATION	15-16
VI.	REVISIONS	17

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY: _____
SHEET: 2 of 17

I. INTRODUCTION

This specification covers the basic requirements for a tumble-blast machine to deburr, clean and/or shot peen production parts with abrasives such as steel shot and steel grit.

II. REFERENCE SPECIFICATIONS

Unless otherwise stated the following Delphi Saginaw Steering Systems specifications are to be considered part of this specification and must be complied with:

1. SD-001 General Manufacturing Equipment Specification.
2. SD-002 Manufacturing Equipment Statistical Qualification Requirements.
3. SD-003 General Drawing and Manuals Specification.
4. SD-004 General Manufacturing Equipment Controls Specification.
5. SD-005 General Gage Specification.
6. SD-006 Design Guidelines for Lean Manufacturing Equipment.
7. SD-007 Preferred Components List.

III. MACHINE – GENERAL CONDITIONS

A. Arrangement

A completely self-contained, floor-mounted system that can be installed under an 18 foot high truss is required which is to be pre-wired with motor(s), controls, and have safety guards.

B. Superstructure

1. The structural steel framework is to be provided for supporting the machine cabinet and all associated components.
2. A platform, with full safety guard rail, and safety ladder is required to service and maintain the abrasive separator, elevator-head section, and drive system but not interfere with maintaining the components underneath.
3. All major items, if any, that broken down for shipping (superstructure, elevator, abrasive separator, etc.) should bolt together with abrasive-tight seals.

C. Blast Cabinet, Doors, and Linears

1. The cabinet housing and doors are to be constructed of steel plate supported by the structural framework.
2. Inspection doors are to provide easy access to all interior working parts. Doors should be hinged with a cam-type locks whenever possible.

MANUFACTURING EQUIPMENT

PURCHASE SPECIFICATION

DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY:
SHEET: 3 of 17

3. Cast abrasive-resistant alloy linears at least ½" thick are to line all portions of the cabinet interior that are subject to the direct or rebound abrasive blast stream (walls, ceiling, barrel heads, mill door, etc.). The linears are to be interchangeable in all machine of this type design.
4. The door is to positively seal when closing and positively lock when opened to insure against undesired closing.
5. The entire cabinet housing and doors are to form an abrasive and dust-tight seal.

D. Mill Work Conveyor

The cabinet housing will be equipped with an endless apron conveyor fabricated of a series of perforated metal flights or an endless molded rubber or polyurethane belt and, when specified, it will be one of the following:

1. Endless rubber belt with multiple ply, heavy duck fabric, with raised ribs and edges. The belt to have ¼" perforations unless otherwise specified for abrasive drainage.
2. Metal Slats – The slats are to be made of U.S.S. grade B manganese steel and have ¼" perforation unless otherwise specified. Each unit to be structurally reinforced with a metal member intermittently welded to the back face of the slat. The links will be cast and machined for uniform fit when bolted to the steel slats. The sprockets, the links, and the pins will be heat-treated for maximum resistance to wear and shock loads. A steel belt may be quoted as an option.
3. The work conveyor is to discharge in a 27 cubic foot capacity gon (overall dimensions of 33" high by 38" wide by 54" long) per drawing PL-3374 and any other discharge container or conveyor.

E. Mill Barrel Heads and Seals

1. Both barrel heads and seals will be made of cast abrasive – resistant alloy, ½" thick minimum.
2. The heads are to be adjustable for flush alignment to the mill work conveyor and prevent parts from becoming jammed, pinched, or caught between any part of the conveyor and barrel heads.
3. Seals that are adjustable to work conveyor and barrel heads are to prevent any gaps where the parts could jam or get caught, especially when unloading.

MANUFACTURING EQUIPMENT

PURCHASE SPECIFICATION

DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY:
SHEET: 4 of 17

F. Mill Drive System

1. The drive will provide gentle tumbling action without danger to the parts or machine.
2. The drive is to have overload protection to prevent damage to work conveyor and barrel heads, especially if parts jam or there is a mechanical failure.
3. Both the conveyor and drive are each to have external accessible take-ups to allow easy adjustment.

G. Wheel Unit

1. The wheel is to direct the abrasive across the parts on the work conveyor with uniform intensity and distribution.
2. The wheel unit is to be driven with multiple V-belt drive arrangement which rotates the wheel and bearing-mounted spindle.
3. The wearable parts in the wheel – such as blades, clockdial control cages, and impeller – are to be made of special cast abrasive – resistant alloy that resists wear. These items are to be held in place with a device which allows quick removal when changing parts. The work area for changing these wearable parts is to be free of obstructions. The side wheel(s) that hold the blades are to be made of $\frac{3}{4}$ " abrasion and shock resistant alloy.
4. A guard housing – constructed of $\frac{1}{4}$ " thick steel plate and internally lined with cast abrasive-resistant liners is to cover the abrasive wheel. Liners are required in the same plane as the face plates of the wheel to confine the abrasive flow and rebound to these planes, thus reducing the wear in the wheel itself. The periphery of the wheel is to be lined, except for the area of abrasive discharge toward, with 1" thick linears. All linears in the housing are to have a labyrinth seal to prevent abrasive wear at the overlap. The guard housing is to support the cast abrasive – resistant linears (each guard housing is to provide gravity drains to return accumulated abrasive to the re-claim system – as in the case of a side-mounted wheel).
5. A bearing-spindle unit with a lubricated type bearing is to support the abrasive wheel, be designed to provide maximum bearing life, and withstand the severe shock loads to which the wheel could be subjected. The spindle should be connected to the automatic lubricated system if supplied as part of the machine.
6. The guard housing, bearing spindle, and motor are to be mounted on a 1" thick steel base plate structurally supported to prevent deflection. The mounting surfaces are to be smooth and have seals to prevent abrasive leakage when the base plate is clamped to the cabinet-mounted surface.

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY:
SHEET: 5 of 17

H. Abrasive Flow Control Valves

1. An abrasive control valve is required for the wheel to meter the quantity (zero to full flow) of abrasive delivered to the wheel. The wheel motor circuit is to have an ammeter to give a visual indication of the abrasive load on the wheel.
2. A Magna Valve shot flow rate control unit (from Electronics Incorporated) shall be used for shot peening processes and shall provide linear performance over the entire range of the operation. A digital meter for each wheel shall give visual indication of the abrasive flow to each wheel.

The information from the Magna Valve inductive sensor, that monitors the flow rate, shall be compared to the desired set point within a dual high-low alarm. Any abnormal flow rate outside of the adjustable dead band shall shut down the blast machine and energize both an indicator light and rotating yellow beacon light on the operator control panel. The abnormal flow rate shall also be indicated as to a high or low fault.

3. A wheel hour time meter is required to record the number of blasting hours and one to record the number of machine operation hours.
4. Directly above the abrasive control valve is to be a manual maintenance shut-off valve positioned in the horizontal plane that can be fully opened and fully closed.

I. Abrasive Re-claim

1. The hopper made of ¼" minimum abrasion resistant plate is to have a screen above the screw to catch linears, wheel parts, cars nuts, and maintenance tools but allow abrasive and scale to pass without plugging.
2. A gravity type hopper forming an integral part of the blast cabinet is to transfer spent abrasive to a helicoid screw conveyor which in turn feeds the material to the boot section of the elevator.
3. Each helicoid screw shall have a separate drive and a zero speed switch.

J. Elevator

1. The elevator associated with the blast cabinet is to be belt and bucket, centrifugal discharge type elevator. The overall height of the elevator is to allow installation under the building truss work.
2. A motor(s) with multiple V-belts to a shaft mounted speed reducer is to drive the elevator, upper, and lower screw and start when subjected to a full abrasive load. A zero speed system with fault interlock is to verify that all shafts are rotating. If the shaft is not directly driven by the speed reducer, use a chain and sprocket drive.

MANUFACTURING EQUIPMENT

PURCHASE SPECIFICATION

DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY:
SHEET: 6 of 17

3. The elevator belt take-up adjustment is to allow setting proper tension and tracking alignment.
 4. During the operation of the shot peening process the elevator shall be sized to handle the additional shot that the shot size classifier and the shot shape sprialor will contribute to the abrasive reclaim system.
- K. Screw Conveyor and Rotary Screen
1. Abrasive discharged from the head spout of the elevator is to be conveyed into a rotary screen by means of a helicoid screw conveyor. The rotary screen is to be mounted on the end of the screw conveyor shaft and contained within the separator casing. The useable size of the abrasive is to pass through the rotary screen to the abrasive separator and main abrasive hopper.
 2. Large particles of foreign materials that pass out the end of the rotary screen are to be delivered to a holding hopper. If any useable sizes of abrasive are discharged out the rotary screen, it is to be returned to the main abrasive hopper.
 3. Abrasion resistant screen and zero speed switch are required.
- L. C.F.S. Abrasive Separator or Equal
1. Machine to be equipped with a C.F.S. abrasive separator.
 2. A screw convey is to deliver the abrasive from the elevator head spout to the separator and distribute it across the full width of the separator. A counterweighted gate must be designed not to retain or carry any abrasive and must allow easy vertical adjustment and counter-weight adjustment. The gate is to discharge a thin, full width abrasive curtain through which a flow of air from the ventilation system is to pull out the abrasive fines and refuse and allow the good abrasive to fall into the main abrasive hopper.
 3. The abrasive fines and refuse, when pulled through the abrasive curtain, are to settle in a plenum with dust laden air taken to the dust collection system.
 4. The fines and refuse in the plenum are to discharge through a discharge valve due to gravity action and then flow down a discharge chute to the dust collector hopper or a refuse container located on either side of the machine. The discharge valve located at the plenum outlet is to remain closed except when fines and refuse are passing.
 5. The main abrasive hopper is to store all the abrasive when the machine is not blasting. The abrasive is to flow to the abrasive flow control valves by gravity spouts. The walls in the hopper that could be subjected to abrasive directly falling on the, as when the system has a low abrasive level, are to be made of ¼" minimum abrasive resistant plate.

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY: _____
SHEET: 7 of 17

M. Shot Size Classifier for Shot Peening Operations

1. The shot size classifier shall consist of several vibrating screens to sort SAE J827 and J444 standard industry steel shot into oversize, undersize, and correct size fractions to be upgraded to meet MIL-S-13165C screen tolerance.
2. While the blast is running, the shot classifier shall constantly operate and process 25% of the shot being returned to the storage hopper.
3. The shot size classifier shall continue operating between process cycles when the blast wheel is not running. Also, the classifier shall continue operating at machine shut down, after use of blast machine had been complete, for such a time that full machine shot charge can be classified for a minimum of one cycle through the classifier has timed out.
4. A valve is required at the top of the classifier for slowing down the acceleration of the shot to minimize damage to the top classifier screen.

N. Abrasive Level Indicator

1. An abrasive level indicator is to be provided to signal the operator when the abrasive level is below normal operating requirements.
2. An electrical capacitance probe is to be mounted in the main abrasive hopper on vibration dampening pads and is to work in conjunction with a "red" and a "green" light located in the operator's control console. When the abrasive in the main storage bin is at the proper operating level, the "green" signal light remains on.
3. When the abrasive drops below a pre-determined level, the "red" light comes on, indicating that additional abrasive is being added to the system with the abrasive adding unit. When the abrasive adding unit has been on for 3 to 5 minutes and the abrasive level has not returned to normal, a rotating yellow beacon light is on the operator control panel is to energize, indicating that more abrasive is required in the abrasive adding unit.

During shot peening operations, when the abrasive-adding unit has been on for 3 to 5 minutes and the abrasive level has not returned to normal, a rotation yellow beacon light on the operator control panel is to energize plus the blast machine shall shut down indicating that more abrasive is required in the abrasive adding unit.

MANUFACTURING EQUIPMENT

PURCHASE SPECIFICATION

DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY:
SHEET: 8 of 17

O. Abrasive Adding Unit

1. An abrasive adding unit is to replenish abrasive to the recycling system automatically whenever the machine abrasive level is low. The abrasive lever indicator is to provide the signal to add abrasive.
2. The unit is to have a hopper that can hold 24 hours of replenishing abrasive and can be loaded from both sides of the machine.
3. The hopper is to have a .12" to .18" opening screen at the very top which is to located no higher than 42" from the floor. The hopper is to have an abrasive flow control metering system set at one hour of abrasive usage per minute of addition.

P. Ventilation

1. The ventilation system is to be designed in conformance with the latest edition of "Industrial Ventilation" by American Conference of Governmental Industrial Hygienists.
2. The necessary negative exhaust pressure is to be supplied by the dust collection system to properly remove the abrasive fines and refuse and also prevent the machine from leaking dust to the plant.
3. A vent plenum is to be provided for ventilating the interior of the blast chamber and be equipped with a vent outlet. The elevator is to have a vent outlet, if required.
4. The ventilation system is to be designed so abrasive and/or abrasives fines do not settle in the ductwork.
5. Baffle gates should be used and located six (6) pipe-duct diameters from the duct entrance, and a gate required before the dust collector inlet.
6. The ventilation duct should slope downward so abrasive cannot settle in the duct if the system gets out of balance.

Q. Loader

1. The loader with bucket is to hold and load the next batch of parts that require blasting.
2. As an option, the loader can have a weight sensing unit for loading the proper amount of parts into the bucket.

MANUFACTURING EQUIPMENT

PURCHASE SPECIFICATION

DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY:
SHEET: 9 of 17

3. The bucket sound deadening and wear plates are to minimize the loading sound level.
4. The loader with bucket when in the non-down position is to be supported against downward movement.
5. The loader guards are to protect the surrounding personnel when the bucket is in motion.
6. The bucket, when in the down position, shall be supported so to prevent pinched feet during loading.

R. Lubrication

1. The wheel unit bearings and other bearings that require lubrication less than every 200 hours are to be lubricated with an automatic system. The automatics lubrication reservoir and metering system are to be located in an enclosure with a plexiglass door that will allow filling the reservoir and maintaining the system. If the machine is controlled by relays, then a Trabon WSC lube controller shall be used (with an additional lube fault light on operator's console).
2. The non-auto lubed bearings are to be anti-friction bearings that are lubricated for life "Neverlube" grease-type. All bearings are to be mounted so abrasive cannot accumulate and get into the races.
3. If automatic lubrication is not used and lubrication is required, then all points shall be solid piped to one common location 42" off the floor. Each point will have its own grease fitting.
4. Lubrication type by Delphi Saginaw Steering Systems code is to be identified on the machine and located at each filling port/point.
5. When a lube fault occurs, the machine shall cycle stop. The fault shall be resettable even though the lube problem still exists. Until the lube problem is resolved, the machine shall stop every cycle. As long as the lube exists, a continuous lube fault indication shall be provided. At the end of the cycle, the machine will again stop and the lube fault indication shall be modified (flashing reverse video, etc.) to indicate that the lube fault is the reason for machine stoppage.

S. Safety Devices

1. Hinged guards should be used whenever possible and shall be interlocked to the control system.
2. The blast-cabinet access door is to be interlocked so that the abrasive wheel or abrasive cannot be on when the door is not fully closed.

MANUFACTURING EQUIPMENT

PURCHASE SPECIFICATION

DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY: _____
SHEET: 10 of 17

3. Safety guards with electrical interlock are required to prevent personnel from going in-between the loader and the blast machine.
4. The operator control console shall be mounted on the side of the loader in such manner to prevent operator harm from moving devices. A clear view from the operator control console, of other personnel in the immediate area, shall be presented to the operator.

T. Machine Controls

1. The blast machine will have on power inlet to its electrical panel. The dust collector will have one power inlet and its own electrical panel.
2. Inter-connections between panels are required so that, when the blast machine is put in "Power On", the dust collector will come on if in "Remote Start Mode". If the dust collector is not running, the blast machine shall not blast.
3. The "Abrasive On" is to be interlocked so it can only come on when the door is closed, automatic lubrication system is on, lower screw, elevator, upper screw, dust collector, elevator zero speed, and aversive wheel are running.
4. The abrasive is to be controlled with selector switch which is to have the following positions: "On" – "Off".
5. A blast time 0-60 minutes is to control the amount of the time the abrasive is on.
6. To raise or lower the loader, the mill door must be fully open and the respective initiation devices held maintained with two (2) hands throughout the loader's full travel.
7. The mill door is to only open if the abrasive is off and the abrasive wheel has stopped rotating as signaled by the wheel motor zero-speed sensing unit.
8. The blast control panel is to have an individual light for each blast machine fault (elevator zero speed, back access door, mill driver overload, etc.) and for when the dust collector or energized.
9. The automatic lubrication status lights are to be mounted on the panel. The system is to only operate when the wheel is running.
10. The abrasive level indicator lights are to be on the panel. A rotating yellow light which energizes after the abrasive adding unit is on for 3 to 5 minutes is to indicate a low-abrasive-adding-unit level.

MANUFACTURING EQUIPMENT

PURCHASE SPECIFICATION

DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY: _____
SHEET: 11 of 17

11. Two (2) mushroom-head emergency stop push buttons are required. One push button is to be located on the control panel, and the other one on the opposite side of the loader.
12. A 100,000 –hour non-resettable hour meter is required to determine the amount of time the abrasive is on. The machine is to have a 100,000 hour non-resettable hour meter to determine the amount of time the machine is running.
13. If relay type logic is used, the blast panel shall start with Number 1CR and the collector panel to start with 100CR. The dust collector panel shall also have 100-series wire numbers.
14. A major junction box is required on the machine for all wires from the electrical panel. The major junction box is to be located above the blast cabinet. All wires are to terminate on the terminal strip in the electrical panel.
15. All electrical, pneumatic, and lubrication controls or sensing items are to be supported off the machine so abrasive cannot build up and interfere with their function.
16. All control lines for the pneumatic, and lubrication controls or sensing items are to be supported off the machine so abrasive cannot build up and interfere with their function.
17. The hoist load sensing unit must have a light on the panel to signal when loaded with parts. The required interlocks must prevent the addition of more parts when loaded or when the hoist is not in the down position (quote as an option).
18. Cycle overtime shall be implemented by timing individual motions/segments of the machine cycle using several timers with settings tailored to the individual motions/segments. Wherever possible, overtime timers should be kept to less than 30 seconds.
19. The controls described in this specification are basically for a machine that is loaded and unloaded by an operator. If complete automatic operation of the machine (load, blast, unload) without an operator, the additional and revised control logic along with safety guards must be discussed with the Delphi Saginaw Steering Systems Process Engineer.

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY:
SHEET: 12 of 17

U. Machine Inspection and Run Off For Blast Cleaning and Deburring

1. After the machine is completed, the Delphi Saginaw Steering Systems Process Engineer will examine the system and processing of parts supplied by Delphi Saginaw Steering Systems on the vendor's floor. The machine must properly process two (2) loads of each part and obtain a 100% blast clean and/or burr free conditions(s) with no machine adjustment and meet the sound level requirements before shipment. The GM-1676 "GENERAL MOTORS CORPORATION VENDORS' SOUND DATA FORM AND CERTIFICATION SHEET" is to be completed with abrasive on and abrasive off (abrasive separation is not required). The vendor's start up personnel of the start up and installation department is responsible for the system, along with the vendor's engineering assistance, is to be present at this inspection to verify that the system will meet Delphi Saginaw Steering Systems purchase order requirements.

Engineering assistance shall document and assist in the required changes for all drawings and technical manuals.

2. Final acceptance of the equipment will be based upon a 40-hour "Abrasive On" blasting production run at Delphi Saginaw Steering Systems without machine adjustments and the contract completed. The vendor will supply all the required technical service during the installation and/or pre-operative stages until final acceptance as part of the base machine cost. Also, the Delphi Saginaw Steering Systems Department Foreman, machine operator, and production engineer in charge of the system are to be trained as how the machine operates, principles on how blasting cleans the parts and separates the abrasive fines and scale, and how to examine items that wear and need replacing and/or adjustments.

V. Almen Specimen Gage Capability Study for Shot Peening

Prior to the machine set up and run off, a gage capability study shall be performed in accordance with SD-005 General Gage Specification

The gage acceptability criteria shall be less than 10% error.

W. Machine Inspection and Run Off for Shot Peening Equipment

1. Machine Set-Up

Prior to reviewing the equipment on the vendor's floor, the following shall have been performed:

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY:
SHEET: 13 of 17

- a. The saturation curve shall have been developed. This data curve showing arc height vs. peening time shall be derived from a minimum of four (4) data points per peening time. The data points shall be spaced over a sufficient range of peening times to estimate the "knee" of the curve and to provide a positive determination of the saturation point. The saturation point is the minimum duration of peening time which, when doubled, increases the Almen strip arc height by not greater than 10%.
 - b. All Almen test strips to be used shall conform to MIL-S-13165C and with the additional requirements:
 1. Flatness ----- ± 0.0005
 2. Hardness ----- $R_c 48.5 \pm 1.5$
 - c. Mechanically deforming test strips to meet the flatness requirements is not permitted.
 - d. 10 assembled Almen strip and holding fixture sets shall be evenly distributed through-out the workload to be processed.
 - e. The 10 assembled Almen strip and holding fixture sets shall be processed with a full load workpieces.
 - f. A total of 50 Almen test strips from five (5) full loads shall be evaluated to meet the arc height and coverage requirements to 50% of the blue print tolerance before approval is given to terminate machine set-up.
 - g. Each Almen strip will receive one reading each for arc height set-up off a test gage with a positive stop on one end.
 - h. A peened Almen strip shall not be re-peened after it has been removed from the holding fixture.
 - i. Each Almen strip will receive one reading each for coverage.
- X. Machine Review On Vendor's Floor – Shot Peening
- After the machine set-up is completed, Delphi Saginaw Steering Systems personnel will examine the system and processing of workpieces on the vendor's floor.
1. The machine must process an additional five (5) full loads with no machine adjustments and meet the sound level requirements.

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY: _____
SHEET: 14 of 17

2. From these test runs, a total of 50 Almen test strips (10 test strips per full load) mounted on holding fixtures will be evaluated using a test gage with a positive stop on one end.
3. After both the spot peening process requirements and the machine inspection have been approved, shipment may begin.

Y. Qualifying a Shot Peening Machine for Shipment

Qualifying the Process Capability (formerly known as Machine Capability) and the Process Performance (formerly known as Process Capability) will be used on the following:

1. 10 Almen test strips are to be collected from each batch as the machine is unloaded.
2. Each Almen test strip will be measured for arc height and visually inspected for coverage. These readings will become the basis for an X-bar and R-chart.
3. The average and range of each group will be plotted on an X-bar and R-chart, and analyzed for statistical control for Process Capability and Process Performance per the SD-002 Delphi Saginaw Steering Systems Manufacturing Equipment Statistical Qualification Requirements issued March 1, 1993. The control limits will be calculated from the sample data.
4. If all points are within the control of variation due to cycles, trends, shifts, etc., then the Process Capability may be calculated from the sample data.

If there are points beyond the control limits or other indications of the presence of special cause of variation, then the cause must be identified and corrected.

In the event of special cause the decision to calculate Process Capability less the out of control data points, or to void the run off and start over, must be based on the nature and the extent of the special cause of variation. If there is any doubt, restart the runoff. The final decision will be made by the Delphi Saginaw Steering Systems Process Engineer.

5. Process Performance will be determined over time on Delphi Saginaw Steering Systems factory floor. It is expected that Process Performance will be reached per the SD-002 Delphi Steering System Manufacturing Equipment Statistical qualification Requirements issued March 1, 1993.

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY: _____
SHEET: 15 of 17

Z. Design Approvals

1. Drawing approval constitutes an acceptance of the design concept. It does not relieve the vendor of the responsibility for proper operation of the equipment.
2. A concept and layout meeting will be held at Delphi Saginaw Steering Systems with the vendor and his design personnel to discuss the design. Three (3) copies of the following drawing will be required:
 - a. Top and side assemble view of system.
 - b. Layout of drive train, moving mechanisms (auger, elevator, rotary, screen, etc.), lubrication system, and ventilation with design calculations and list of purchased components.
 - c. Sequence of electrical and pneumatic controls with interlock along with proposed diagram.
 - d. List major purchased components, including mechanical, electrical, pneumatic, lubrication, etc.
 - e. All vendor standard drawings that will be supplied but not drawn on Delphi Saginaw Steering System's paper but will have Delphi Saginaw Steering System's title blocks.
 - f. Preliminary list of drawing that will be drawn on Delphi Saginaw Steering System's paper for detail approval meeting.
 - g. Assembly view of all moving mechanisms.

IV. WARRANTY

The following will be in addition to the warranty stated in SD-001.11:

Abrasive leakage (especially that causing plies of abrasive to the exterior of the machine, except that associated with normal maintenance) is the vendor's responsibility to correct for the first 500 hours of blasting on Delphi Saginaw Steering Systems factory floor.

V. QUOTATION

- A. The vendor is expected to discuss Delphi Saginaw Steering System's requirements with the Process Engineer in order to fully understand all details in this specification before the proposal is submitted.

MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION DELPHI SAGINAW STEERING SYSTEMS

TITLE: Tumble Blast Equipment
ISSUED BY: Manuel Gonzalez
REVISION:

DATE: 12/6/95
DATE:

NUMBER: SD-1009
APPROVED BY: _____
SHEET: 16 of 17

- B. By submitting a quotation the vendor automatically agrees to conform to these Delphi Steering Systems specifications. If for any reason the vendor does not agree with these specifications, or any single part of these specifications, a request for deviation must be included in numerical order in the quotation, and written approval of the deviation(s) required must be obtained from the Process Engineer responsible for the equipment before an order can be issued. All deviations should be discussed with the Process Engineer be quoting.
- C. The quotation shall include this statement: "WE HAVE READ AND AGREE TO CONFORM TO DELPHI SAGINAW STEERING SYSTEMS MANUFACTURING EQUIPMENT PURCHASE SPECIFICATION SD-1009".

**MANUFACTURING EQUIPMENT
PURCHASE SPECIFICATION
DELPHI SAGINAW STEERING SYSTEMS**

TITLE: Tumble Blast Equipment	NUMBER: SD-1009
ISSUED BY: Manuel Gonzalez	DATE: 12/6/95
REVISION:	APPROVED BY: _____
	SHEET: 17 of 17

SPECIFICATION REVISION SHEET

PAGE #	REV SYMBOL	REVISION DESCRIPTION	DATE	ISSUED BY	Approved By
		<ul style="list-style-type: none">Rewritten as SD-1009 was E-1900	11-3-95	M. Gonzalez	D. Hitz
		<ul style="list-style-type: none">			
		<ul style="list-style-type: none">			